For Army Aviation, Dramatic Developments in Mission Planning and Network Communications

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Army aviation tactics evolved dramatically in the 1960s, as the use of helicopters in the Vietnam conflict forever changed the American doctrine of tactical warfare. But for all the advances of the decade, there was no concept of digitization or interoperability. Army aviation conducted missions quite differently from today's aviators. American combat units were able to conduct tactical airmobile missions, including insertions and extraction of ground forces, aerial reconnaissance, downed aviator recovery, and support with aerial weapons. Units planned with pencil and paper in their tactical operations centers and carried graphics hand-drawn on clear plastic overlays to the company command posts. Aviators talked over unsecure radios using "Hollywood" call signs. Frequency Modulation (FM), Very High Frequency (VHF), and Ultra HF (UHF) radios were in use with no ability to speak securely or to frequency hop. Secure HF radios were only daydreams.

An Army CH-47 Chinook departs from Kandahar Airfield, Afghanistan, Dec. 27, 2009. (U.S. Air Force photo by TSgt Francisco V. Govea II.)

Maturation of Army Aviation Technology

By the 1970s, military aircraft were morphing into flying sensor platforms; making large amounts of electronic equipment work together was the new challenge. Integrating the steady stream of improved instruments, radios, radar, fuel systems, engine controls, and radio navigation aids brought the term "avionics" to the military lexicon.

Post-Vietnam Army aviation faced threats from the Cold War and North Korea. While mission planning remained largely unchanged from a technical standpoint, aviation mission equipment began to mature significantly. Aircraft radios began to "go secure" as electronic encryption, electronic countermeasures, and transponders became commonplace on all Army rotary-wing aircraft. Aircrews were taught how to fill the secure radio with a variety of keying devices. In-air coordination relied on voice communication; passing of information was done by aircrews trained in use of the brevity codes and Signal Operating Instruction authentication techniques.

The fielding of the UH-60A Black Hawk and AH-64A Apache during the 1980s brought giant technological steps forward, including UHF radios with have-quick (anti-jam) capabilities. Battalions were streamlined into leaner organizations with smaller company units. Aviation Intermediate Maintenance units stood up to provide back-shop support that was not organic to the smaller battalions. Along with the Apache and Black Hawk, the first truly digitized aviation platform, the OH-58D (later renamed the Kiowa Warrior) Scout Helicopter, was coming online. The Kiowa Warrior's ability to precisely locate distant targets and digitally conduct call-for-fire missions was something new to Army aviation.

The introduction of the Single Channel Ground to Air Radio System in the early 1990s ushered in more sophisticated FM communications, including the ability to frequency hop and transmit securely. The widespread use of Global Positioning System (GPS) technology for navigation in the late 1990s led the Army to integrate GPS capability into new systems and to configure GPS updates to many legacy platforms. The 1990s also saw the first-generation Aviation Mission Planning System (AMPS), which allowed aircrews to plan routes digitally on a dedicated computer system and transfer that information to an aircraft via a data transfer cartridge. The AMPS represented a huge capability leap in mission planning, which previously was done with pencil, plotter, maps, and acetate.

The fielding of the UH-60A Black Hawk and AH-64A Apache during the 1980s brought giant technological steps forward. Here, an Apache AH-64 helicopter conducts a mission in Iraq in April 2007. (U.S. Army photo.)

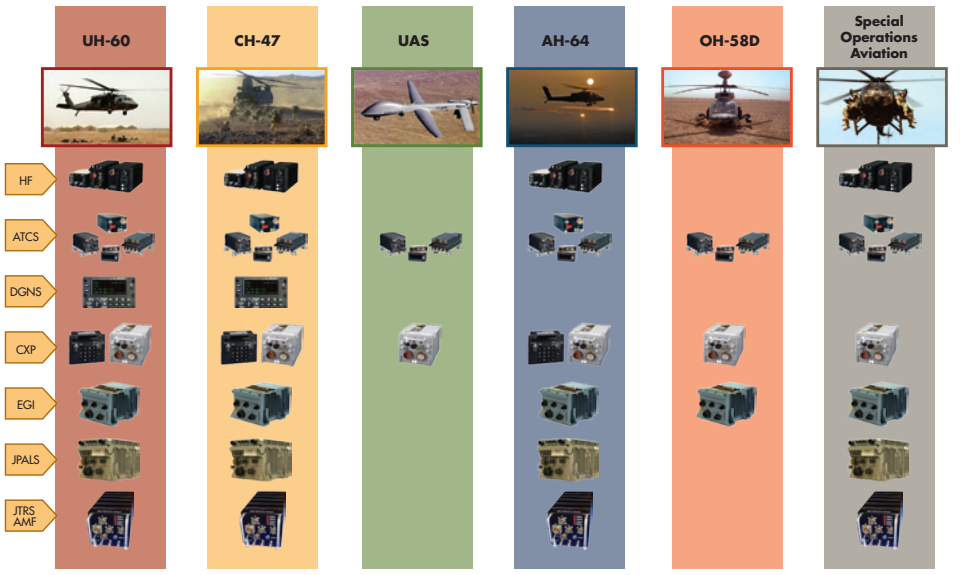
Interoperability Efforts

The 21st century has seen the interoperability of Army aviation systems improve dramatically in the first decade. Emerging from the vision of then-Army Chief of Staff GEN Gordon R. Sullivan in 1994, today's complex battlefields integrate elements from all branches of service with civil elements and require interoperability never dreamed of during the Vietnam conflict.

Interoperability was formally defined by the Chairman of the Joint Chiefs of Staff ADM Michael Mullen in December 2008 as "the ability of systems, units, or forces to provide data, information, materiel, and service to and accept the same from other systems, units, or forces and to use … them to operate effectively together. Information technology and National Security System interoperability includes both the technical exchange of information and the operational

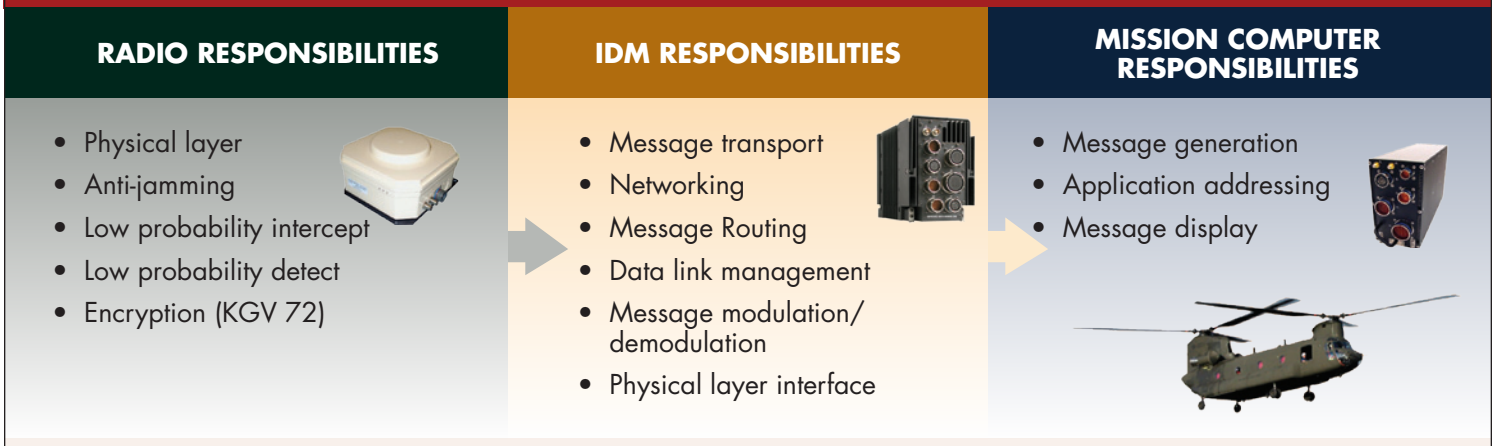
FIGURE 1. AVIATION MISSION EQUIPMENT

Improving Aircraft Performance through Avionics Acquisition



HF: High Frequency
ATCS: Aviation Tactical Communication System
DGNS: Doppler Global Positioning System (GPS) Navigation System
CXP: Common Transponder
EGI: Embedded GPS Inertial Navigation
JPALS: Joint Precision Approach and Landing System
JTRS AMF: Joint Tactical Radio System Airborne Maritime Fixed

FIGURE 2. IMPROVED DATA MODEM INTEROPERABILITY



effectiveness of that exchanged information as required for mission accomplishment. Interoperability is more than just information exchange. It includes systems, processes, organizations, and missions over the life cycle and must be balanced with Information Assurance."

The Project Management Office Aviation Systems (PMO AS) includes two product management organizations that support successful interoperability of Army Aviation systems: the Product Manager for Aviation Mission Equipment (PM AME) and the Product Directorate for Aviation Networks and Mission Planning (PD ANMP).

The PM AME was established as a centralized management office to develop and field common avionics enablers, ensuring that shared solutions are used across the Army aviation fleet (see Figure 1). This commonality allows the Army aviation community to reduce risks and costs in researching and developing minimal solutions and to realize substantial cost savings by leveraging purchase quantities.

PM AME, which is responsible for managing all communications, navigation, and surveillance capabilities required by Army aviation, currently procures, fields, and supports the following major systems:

- Doppler GPS Navigation System, a navigation capability with a 6-channel GPS receiver embedded in the signal data converter of the currently fielded Doppler navigation system.
- Embedded GPS Inertial Navigation, a tri-service, U.S. Air Force-led effort to provide extremely precise location information to the aircraft fire control computer or integrated system processor responsible for targeting information and sensor pre-pointing.
- Joint Precision Approach and Landing System, a joint operational capability for U.S. forces to perform assigned missions from fixed-base, tactical, shipboard, and special operations environments under a wide range of meteorological conditions.
- Common Transponders, which incorporate all the advanced features required in today's global military and civil air traffic control environments by using an open system architecture design and high-density circuit technology to ensure ongoing versatility and future utility through software-only upgrades.
- Single Channel Ground and Airborne Radio System, a tactical airborne radio subsystem that provides secure, anti-jam voice and data communications with single-frequency and frequency-hopping modes.
- Aviation Tactical Communication System, an airborne VHF/UHF line-of-sight and tactical satellite system that supports DOD requirements for airborne, multiband, multimission, secure anti-jam voice, data, and imagery network-capable communications in a compact radio set.
- HF Radio, an easy-to-operate, multifunctional, fully digital signal processing HF radio intended to provide reliable digital connectivity for airborne applications.
- Joint Tactical Radio System Airborne Maritime Fixed, the transformational 2-channel radio system and common ancillaries that support platform integration and joint service interoperability.

Communications and Mission Planning

In 2009, PD ANMP stood up with the mission of providing the warfighting aviation community with materiel solutions necessary to maintain, integrate, and improve communications and mission planning. The primary products used to accomplish this mission are the Improved Data Modem (IDM) and AMPS.

The IDM, developed as a fully digital replacement for the Airborne Target Handover System (ATHS) of the 1980s, was designed by the U.S. Navy in 1991 for U.S. Air Force short-range, close-air support data communication. It was subsequently adopted by the Army to satisfy the unique Army aviation requirements to connect the Tactical Internet for Command and Control (C2) with the Aviation Tactical Operations Center.

FIGURE 3. THE AVIATION MISSION PLANNING SYSTEM

The requirements for the exchange of C2 and situational awareness (SA) data have evolved considerably since the days of ATHS, and the IDM remains a dynamically evolving product, facilitating a digital transmission network for the sharing of SA, sensor information, and tactical data among our digitized Army, joint, and coalition aviation partners. The IDM serves as the crucial interface between platform mission computers and radios, supporting legacy VHF and UHF radios and Blue Force Tracker (BFT), with efforts underway to ensure future support of the BFT 2 and Joint Tactical Radio System (see Figure 2 on Page 22). As a single line-replaceable unit performing communication modulation and demodulation, database processing, and message processing functions for the aforementioned aviation team members, the IDM presents a multipath approach to C2 in the tactical environment.

As Army aviation's digitized, integrated C2 and SA solution, the IDM hosts Force XXI Battle Command, Brigade-and-Below-Air, processes Air Force Applications Program Development, and enables Joint Variable Message Format for use with Advanced Field Artillery Tactical Data System messages. These capabilities further enhance aviation's combat multiplier effect and help prevent fratricide on the battlefield by providing timely target data to warfighters, and control measures and SA to battlefield commanders.

The AMPS is a mission-planning and battle synchronization tool that automates aviation mission-planning tasks and generates mission data for use in hard copy or electronic format. At the brigade and battalion echelons, AMPS acts as a conduit for a flow of common-operating-picture information from Army Battle Command Systems (ABCS) to an environment where mission planning can occur (see Figure 3). As a complementary system to ABCS, the AMPS at the brigade and battalion echelons is used to set routine mission parameters that fit in the ground commander's scheme of maneuver. The company-level mission planner is used to conduct rehearsals and select attack-by-fire positions, routes from the release point, routes to rally points, and other company details to complete the plan. The company also uses the mission planner to load data cartridges that push mission parameters to each aircraft mission computer. The AMPS transmits these plans into the Tactical Airspace Integration System, which is managed by another PM AS Product Office, to de-conflict airspace.

Successfully managing systems that help the warfighter meet interoperability requirements will continue to be a high priority for PM AS. Working in a resource-constrained environment will require smarter processes and technologies to ensure that capabilities required across the Army satisfy similar requirements for both ground and aviation systems. As we move forward in integrating Army air and ground forces with other services and other nations, PM AS will continue to provide the best support possible to our warfighters.

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